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West Virginia University
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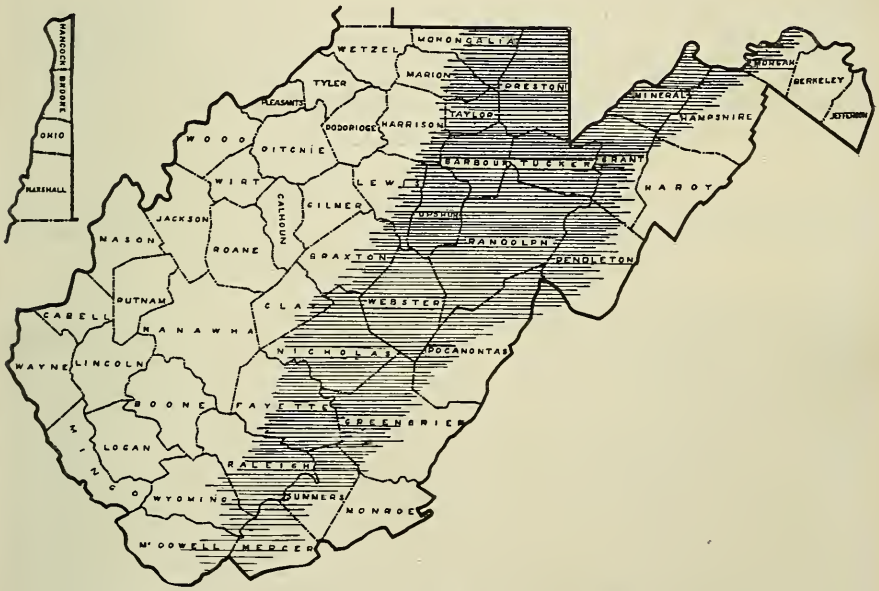
AGRONOMY DEPARTMENT

Experiments With Buckwheat



Shaded Area Shows the Section of West Virginia Best Adapted to the Growing of Buckwheat.

BY

F. W. STEMPLE

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* In co-operation with U. S. Dept. of Agriculture.

CONCLUSIONS AND RECOMMENDATIONS

1.—Acid phosphate has given a large increase when applied to buckwheat, and its use is recommended. Apply 200 to 300 pounds per acre.

2.—Nitrate of soda and sulfate of potash have not given economical returns. A system of farming whereby organic matter and nitrogen supply can be maintained by use of legumes seems best. The potash should be made available through the action of organic matter on the potash supply of the soil, there being a large amount of this material present in West Virginia soils. Manure is usually reserved for the other crops, but buckwheat responds well to its application.

3.—Early preparation of seed bed has increased buckwheat production materially. Where buckwheat is used to take the place of a grain crop that has failed, disking and harrowing is all that is necessary. Sod ground should be plowed as long in advance of seeding as possible. A good, well-settled and well-worked seed bed pays best returns. This point can hardly be emphasized too much.

4.—There seems to be little difference in yield between seeding with a drill and seeding broadcast. Drilling usually requires less seed than broadcasting.

5.—There is little difference in the yield from the use of 4, 5, or 6 pecks per acre, the experiments indicating that 4 pecks per acre are sufficient As buckwheat matures in 60 to 70 days from sowing, it may be sown just late enough to mature before frost. The grain fills out better if it matures during the fall season. The time of seeding is anywhere from June 15 to July 25, the best date for the state being, perhaps, about July 15. For most parts of the state this gives plenty of time to escape frost. Sow from 3 to 5 pecks per acre. The best rate is probably 4 pecks per acre.

6.—Japanese buckwheat gave a better yield than Silver Hull.

7.—No advantage was obtained from mixing varieties.

8.—Buckwheat has not proved to be a good nurse crop.

Experiments With Buckwheat*

By F. W. Stemple

It has long been realized that buckwheat is one of the leading crops in West Virginia, this being the fourth state in the Union in the production of buckwheat.

Place in Cropping System.—Buckwheat does not belong in any regular cropping system. It is an ideal grain catch-crop. When a meadow or a grain field in the regular rotation fails there is no better crop to fill up the loss. Buckwheat is a good crop—there is no better where climatic conditions are right—to sow on new ground or ground that has long been out of cultivation. On poor ground there is no grain crop that can compete with it.

Climate for Buckwheat.—Buckwheat does best where the summers are moderately cool. Preston County in this state possesses ideal conditions for the crop. Other counties in the state where buckwheat seems to do best are: Tucker, Taylor, Barbour, Upshur, Randolph, Grant, Morgan, Nicholas and Raleigh. The census report shows that all counties in the eastern mountain regions of the state produce considerable buckwheat.

Yield.—The average yield per acre for the state in 1910 was 16 bushels. With the right kind of care this production can be considerably increased. Proper preparation of the seed bed, the use of fertilizers, and care in seeding will produce yields as high as 50 bushels in regions adapted to buckwheat.

In 1898 the first experiments with buckwheat at the West Virginia Agricultural Experiment Station were started. These were continued for five years and then dropped. In 1914 further experiments were started and continued to the present time. This bulletin is written to give the results of these latter experiments. The results of the earlier experiments have already been reported in Bulletin 84 ** of the West Virginia Station, but since it is out of print it seems best to include a summary of that bulletin in the present one. The earlier work was done on the use of fertilizers, on time of seeding, and on variety testing. The recent work has been done on preparation of seed bed, rate of seeding, method of seeding, variety testing, and testing buckwheat as a nurse crop. The earlier work on time of seeding and variety testing and the recent work was done on the Experiment Station farms at Morgantown.

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* Acknowledgment is made to I. S. Cook and W. B. Kemp for planning and carrying on the work on preparation of seed bed, method and rate of seeding, variety testing, and use as a nurse crop during the first two years of the investigation.

** Stewart, J. H. and Atwood, Horace—Experiments With Buckwheat and Oats—Bulletin 84, W. Va. Agr'l. Experiment Station, Morgantown.

USE OF FERTILIZERS

The following table summarizes the results with fertilizers upon the experimental plats in Preston County from 1898 to 1902 inclusive.

TABLE I.—Results of Fertilizer Tests in Preston County in 1898-1902, Inclusive.

Treatment	Average Rate of Application	Yield in Bushels Per Acre					
		1898	1899	1900	1901	1902	Average
Nitrate of Soda	244 lbs.	17.5	10.0	23.8		23.4	18.7
Potassium Sulfate	240 lbs.	21.2	17.7	23.1		26.6	22.2
Acid Phosphate	275 lbs.	43.7	31.6	40	39.6	31.4	37.3
Acid Phosphate Nitrate of Soda	200 lbs. 163 lbs.			28.3	38.7	46.8	37.9
Potass. Sulfate Nitrate of Soda	157 lbs. 163 lbs.			23.1		34.6	28.8
Acid Phosphate Potass. Sulfate	200 lbs. 157 lbs.			28.1	39.4	42.9	36.8
Acid Phosphate Potass. Sulfate Nitrate of Soda	177 lbs. 101 lbs. 141 lbs.			25.4	40.2	35.1	33.6
No treatment		17.5		22.0	22.7	24.7	21.7

During part of this time fertilizer experiments were carried on on the Station farm in which acid phosphate gave an average yield 28 per cent greater than sodium nitrate and 21.4 per cent greater than potassium sulfate, which results only help to emphasize the facts shown in Table I.

To emphasize the results of Table I, the following table is given:

TABLE II.—Returns From Use of Fertilizers on Buckwheat.

Treatment	Average Gain Over No Treatment	Average Value of Gain *	Average Cost of Fertilizers **	Ave. Gain Over Cost of Fertilizer	Returns for $1 Expended for Fertilizer
Nitrate of Soda	-3. bu.	-$ 3.75	$ 9.76	-$13.51	-$ 0.38
Potassium Sulfate	.5 bu.	.63	12.00	-11.37	0.05
Acid Phosphate	15.6 bu.	19.50	3.57	15.93	5.46
Acid Phosphate Nitrate of Soda	16.2 bu.	20.25	9.12	11.13	2.22
Potassium Sulfate Nitarte of Soda	7.1 bu.	8.87	14.37	-5.50	0.61
Acid Phosphate Potassium Sulfate	15.1 bu.	18.87	10.45	8.42	1.80
Acid Phosphate Potassium Sulfate Nitrate of Soda	11.9 bu.	14.87	12.99	1.88	1.14

*Value of buckwheat $1.25.
**Acid phosphate $26, nitrate of soda $80 and potassium sulfate $100 per ton.

The results here given are very similar to results reported in Bulletin 155 of the West Virginia Station, in which the following conclusions are found:

"The importance of acid phosphate as a crop producer is such that one need not hesitate to buy and apply it in liberal quantities."

"In determining which fertilizing material or mixture of fertilizing materials is the most profitable several things must be taken into consideration. In applying the complete fertilizer we may secure a larger yield but we also have more crop to handle, more fertilizer to haul to the farm and apply, more money invested in fertilizer and consequently a heavier risk to run, against which we must be insured."

Under the best systems of agriculture every attempt possible to keep up the organic supply is made. Nitrogen is supplied through the agency of legumes. As a general principle the use of phosphorous-bearing fertilizers is to be recommended and as a result of this experiment the conclusion is easily drawn that a fertilizer for buckwheat should be rich in phosphoric acid. The use of potash and nitrogen-bearing fertilizers has not paid and evidently will not where organic matter and nitrogen supply is maintained by a careful use of legumes.

PREPARATION OF SEED BED FOR BUCKWHEAT

A great many farmers seem to think that it is not necessary to pay very much attention to the amount of care used in the preparation of a seed bed for growing buckwheat. In 1915, experiments were started on the Station farm to compare early plowing with late plowing in order to note the effect of each on the yield of buckwheat. The following table gives the results:

TABLE III.—Effect on Yield of Early vs. Late Plowing for Buckwheat.

Time of Plowing	Average Date		Yield Per Acre Bushels				Average	Average Gain for Early Preparation
	of Plowing	of Seeding	1915	1916	1917	1918		
Early	May 6	July 18	43.6		25.17	20.52	29.76	8.65
Late	July 1	July 18	35.3		14.45	13.57	21.11	

In 1915 the time between plowing and seeding for the early plots was 84 days; in 1917, 77 days; and in 1918, 57 days. By examining the figures of Table III it is seen that there is a great deal of difference in favor of early preparation of seed bed for the different years. It seems that plowing the ground anywhere from 30 to 60 days before

seeding is most desirable, since too long a time between plowing and seeding will give too great a chance for weeds to get a start. However, frequent harrowing before seeding will be of great aid in getting rid of some of our worst weeds.

On the late plowed land the seed bed was harder to get into good condition, because of its tendency toward being cloddy.

The final average on this work is the average yield of 59 plots each for early and late plowing. The average rate of seeding for all plots was 4 pecks per acre. The results for each year as well as the average results have showed that it is a poor practice to wait until a few days before seeding to get a seed bed ready for buckwheat.

METHOD AND RATE OF SEEDING

Another object of the experiments was to determine whether or not there is any difference in the yield of buckwheat when sown broadcast or when drilled, and further to determine the best rate of seeding at the Station farm.

TABLE IV.—Effect on Yield from Broadcasting vs. Drilling Buckwheat, and for Different Rates of Seeding.

Method and Rate of Seeding	Yield Per Acre (Bushels)				
	1915	1916	1917	1918	Average
Drilled 2 pks. per Acre			21.11	19.3	20.2
Drilled 3 pks. per Acre	38.75	11.55	21.25	22.3	23.46
Drilled 4 pks. per Acre	39.35	11.85	24.43	20.9	24.13
Drilled 5 pks. per Acre	38.7	10.95	24.03	23.4	24.27
Drilled 6 pks. per Acre	41.2	10.85	24.84	21.2	24.52
Drilled (Av. of all rates)	39.5	11.3	23.13	21.4	23.83
Broadcast—4 pks. per Acre	40.35		24.83	21.5	28.89

In 1916 no tests were made for broadcasting, consequently the average yield was much larger than for drilling. The average yield for 4 pecks (the rate used in broadcasting) drilled for all years, except 1916, is 28.23 bushels and the average of all rates of seeding drilled, except 1916, is 28.01 bushels, giving for broadcasting .66 bushel more than for drilling at the same rate and .88 bushel more than for drilling for the average yield of all rates of seeding.

In averaging the rates of seeding it will be noticed that the yield increased gradually from 2 to 6 pecks. However, the difference in

yields above 4 pecks will hardly pay for the extra seed needed in planting and may be due to differences in plots. It, therefore, seems that one would not be safe in planting less than 4 pecks if he wished a uniform and perfect stand, nor more than 4 pecks if he wished to be economical.

Broadcasting seems to be as good a method of seeding buckwheat as drilling, although it is doubtful whether one can seed less than 4 pecks by hand as evenly as he can with a drill.

VARIETY TESTING OF BUCKWHEAT

There are two well known and popular varieties of buckwheat, Japanese and Silver Hull. The Japanese is larger and considerably darker than the Silver Hull, and there is a tendency for the edges of the hull to extend into a sort of a wing. The Silver Hull is silvery gray in color and has a glossy, smooth appearance. The Japanese is said to be less affected by the hot sunshine and, therefore, less liable to be blasted. The Japanese is taller than the Silver Hull.

This experiment was planned to test the yielding qualities of the two varieties and also to determine whether or not the yield is affected by mixing the two on the theory that the shorter growth and greater shade-resisting power of one will serve to increase the seed bearing area and thus increase the yield of grain. In other words, the seed bearing portion of the shorter plant, if shade resistant, will bear seed in the shade of the taller plant and yet not influence the taller plant. The following table gives some idea in regard to this point.

TABLE V.—Comparison of Yields of Japanese, Silver Hull, and Japanese and Silver Hull Mixed.

Rate of Seeding		Yield Per Acre (Bushels)				
Japanese	Silver Hull	1915	1916	1917	1918	Average
4 pks.		41.05	11.85	27.09	20.9	25.22
	4 pks.	35.9	11.75	22.70	15.4	21.44
2 pks.	2 pks.	42.95	13.00	23.24	19.7	24.72
3 pks.	1 pks.		11.75	23.51	22.2	19.15
1 pks.	3 pks.		11.60			11.6
Mixed Plots (Ave. all rates)		42.95	12.12	23.37	20.9	24.83

The average yield for Japanese is 3.78 bushels better than for Silver Hull. Tests carried out in earlier years show also that Japan-

ese is the better yielder. Mixing the seed has in no instance given a better average yield than with Japanese alone. In 1915 and 1916 a small gain was obtained for mixing. These experiments seem to indicate that mixing two varieties differing in adaptions to shade and sunlight, like the Japanese and Silver Hull, has no effect whatever in increasing the yield.

EARLY AND LATE PLOWING FOR BUCKWHEAT UNDER VARYING CONDITIONS.

It is interesting to notice what effect early and late plowing for buckwheat has on yield under the varying circumstances discussed in this bulletin. The following table gives data on this subject:

TABLE VI.—Effect of Early and Late Plowing for Buckwheat Under Varying Conditions.

Method of Seeding	Rate of Seeding		*Average Yield Per Acre (Bushels	
	Japanese	Silver Hull	Early Plowed	Late Plowed
Drilled	2 pks.		20.2	13.78
Drilled	3 pks.		23.46	13.96
Drilled	4 pks.		24.13	16.61
Drilled	5 pks.		24.27	14.81
Drilled	6 pks.		24.52	11.86
Broadcast	4 pks.		28.89	16.08
Drilled	4 pks.		25.22	12.65
Drilled		4 pks.	21.44	12.56
Drilled **	2 pks.	2 pks.	24.72	12.45
Drilled	3 pks.	1 pk.	19.15	12.55
Drilled	1 pk.	3 pks.	11.6	

* The average for early plowing is for 4 years, and for late for 2 years.
** Mixed seeding.

From this table we see that late plowing does not change the conclusions that one might draw as to the best rate of seeding, method of seeding, or as to value of varieties. Two pecks does not give as much as 3 pecks, nor 3 pecks as much as 4 pecks, no matter whether the farmer gets his ground plowed early or late. In either condition, 4 pecks seems to be the best rate of seeding. Whether the ground is prepared early or late, broadcasting is as effective as drilling; mixing seed has given no advantage; and it is shown that the Japanese variety is superior to the Silver Hull.

EFFECT OF BUCKWHEAT AS A NURSE CROP.

Many farmers in West Virginia report that they have been fairly successful in using buckwheat as a nurse crop. Only one year's work (1915) has been done at this Station on this subject and, while the results cannot be said to be conclusive still they are fairly indicative of what one might expect when grasses or legumes are sown with buckwheat as a nurse crop in an unfavorable season.

TABLE VII.—Effect of Buckwheat as a Nurse Crop on Certain Legumes.

VETCH

	Late Prepared Ground			Early Prepared Ground		
	East End, No Nurse Crop	Center, Buckwheat as Nurse Crop	West End, No Nurse Crop	East End, No Nurse Crop	Center, Buckwheat as Nurse Crop	West End, No Nurse Crop
Plants per sq. ft.	*	.5	.9	*	.8	1.1
Length of longer runners in inches	28	9	18	33	10	18
Percent of ground covered	95	25	40	100	30	40
Height in inches	5	2	3	7	2	3

* Matted too much for counting.

CRIMSON CLOVER

Plants per sq. ft.	2*	.9	1.4	3.3	1	1.5
Percent of ground covered	30	6	30	50	10	30
Height in inches	5	3	4	6	3	4

* Poor stand largely due to low germination of seed.

RED CLOVER

Plants per sq. ft.	8	5	4	6.7	3.8	7.4
Percent of ground covered	* 60	30	85	95	35	50
Height in inches	6	2	6	7	2	5

* Partially tramped out.

ALFALFA

Plants per sq. ft.	*	6	5	6	6	4
Percent of ground covered	*	40	50	70	40	45
Height in inches	*	4	18	21	4	16

* Tramped out.

It can be seen that both in the late and early prepared ground in every case better stands of vetch, crimson clover, red clover, and alfalfa were obtained on the ends where there was no nurse crop than in the center of the plots where buckwheat was used, and further that the condition of growth was much better. Clovers will grow with buckwheat in a favorable season but in a dry season the rapid growth and the heavy shading of buckwheat is harmful to any companion crop.